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Injuries in Norwegian Early Childhood and Care (ECEC) Institutions

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Abstract: Children's play and exploration involves risk and a possibility for being injured. Early childhood and care institutions (ECECs) should provide children with physical challenges in a safe environment. Over the past years, the attention towards playground safety and injuries in ECECs has increased. Norwegian practitioners have a liberal approach to children's risk taking in play, raising questions on injury prevalence in Norwegian ECECs. The aim for this study was to gain knowledge about the injury prevalence and characteristics of the injuries in Norwegian ECECs. Managers from 2105 institutions completed an electronic questionnaire retrospectively asking the managers to report injuries and accidents the past year. The results indicate that injuries are rare in Norwegian ECECs, and that most of the injuries are minor and do not require a follow-up from professional medical personnel. The moderate and severe injuries are very rare, and often mishaps. There are some indications that boys experience injuries more often than girls do and that the most injuries happen outdoors. The main cause of moderate injuries is falling, both outdoors and indoors.

Keywords: ECEC, injury, injury prevention, risk taking

Introduction

In the Norwegian Kindergarten Act (NMER, 2005) and the Framework Plan for the Content and Tasks of Kindergartens (NMER, 2006/2011), there is an emphasis on children's opportunities for play, exploration, meaningful experiences and activities in safe yet challenging environments. This implies a focus on both good and stimulating play environments and the possibility of their utilization while addressing how these environments should constitute a secure frame for their activity. Still, accidents where children experience injuries while spending time in early childhood and care (ECEC) institutions (ECECs) can occur, and finding the balance between ensuring children an optimal development and avoiding serious injuries is a challenging task (BFD, 2000; Hagen & Sandseter, 2010). In ECECs, there is the goal that children should be safe, and ECECs have to work systematically to avoid serious injuries that could lead to invalidity—or death in the worst-case scenario. At the same time, children have the right and need to be able to explore and be active, even though this could result in some minor injuries.

Because of the injuries occurring on children's playgrounds and the wish to create a safe play environment for children, formal risk-managing strategies have emerged in several countries. These primarily include regulation of the physical features of children's play environments and playground equipment, such as maximum fall height, impact absorbing surfaces, sharp edges, unstable equipment and the likelihood of being trapped, pinched, crushed or struck (Ball, 2002, 2004; Chalmers, 2003; DSB, 1996; Little, 2006; Mowat, Wang, Pickett, & Brison, 1998). These laws have been made on the basis of accident research showing that the majority of playground injuries result from falls from swings, slides, climbing frames, and bicycles or other equipment and from being hit, pinched, or crushed in swing equipment (Ball, 2002; Bienefeld, Pickett, & Carr, 1996; Chalmers et al., 1996;; Mack, Hudson, & Thompson, 1997; Peterson, Gillies, Cook, Schick, & Little, 1994; Phelan, Khoury, Kalkwarf, & Lamphear, 2001; Sawyers, 1994).

Statistics of playground injuries from several countries show, however, that despite recent safety legislation to govern playground equipment in order to make play safer, playground injuries have not decreased (Ball, 2002; Briss, Sacks, Adiss, Kresnow, & O'Neil, 1995; Chalmers, 1999, 2003; Phelan et al., 2001). Still, the most serious playground injuries that result in death or severe invalidism are rare (Ball, 2002; Bienefeld et al., 1996; Chalmers, 2003; Chalmers et al., 1996; Phelan et al., 2001). In the UK, one fatal injury occurs every three or four years (Ball, 2002). Most playground injuries are bruises, contusions, concussions and fractures resulting from falls or from collisions with swings, slides, climbing frames, or other equipment (Ball, 2002; Bienefeld et al., 1996; Mack et al., 1997; Phelan et al., 2001; Sawyers, 1994), bicycling (Chalmers et al., 1996; Peterson et al., 1994), and a few due to rough-and-tumble play (Humphreys & Smith, 1987).

Although all ECECs in Norway have playgrounds, statistics from playground accidents is not directly transferable to injuries in ECECs because of more supervision and attention from trained ECEC staff. Research has indicated that lack of supervision is one of the causes of childhood injuries in play (Morrongiello, 2005; Morrongiello, Carbett, McCourt, & Johnston, 2006; Taylor & Morris, 1996). In accordance with this, studies have shown that children attending childcare centres, e.g., institutions in which supervision by adults is usually rather extensive, experience fewer injuries than children spending their days at home with their parent(s). Also, injuries in childcare centres are mostly minor (Briss, Sacks, Adiss, Kresnow, & O'Neil, 1994; Leland, Garrard, & Smith, 1993; Schwebel, Brezausek, & Belsky, 2006). An important factor in injury prevention is a well-functioning balance between letting the children explore and enhance their own risk management (Sandseter, 2010) and adults' supervision and support of children's activities (Morrongiello, 2005; Smith, 1998). In Norway there are signs that this balance is shifting towards a more restrictive approach where children's possibilities for challenges and risky play are limited (Sandseter & Sando, 2016).

International research on injury prevalence in childcare institutions show that the occurrence is very low, and most common injuries in ECECs are minor injuries that are natural for active children, such as scrapes, small cuts, bruises and less serious fractures (Briss et al., 1994; Cummings, Rivara, Boase, & MacDonald, 1996; Leland et al., 1993; Schwebel et al., 2006). This is assumed to be a result of the high degree of supervision from adults in ECECs (Sandseter, 2010), and this is supported by research that has found a lack of supervision from adults as one of the primary risk factors for injuries during children's play (Morrongiello, 2005; Morrongiello et al., 2006). Morrongiello (2005) found that mothers' attitudes towards supervision was strongly related to the child's injuries, were children of mothers being frequently monitored had fewer medical attended injuries than children without constant supervision.

Studies have shown that boys in general have a tendency to experience injuries more often than girls (Hillier & Morrongiello, 1998; Morrongiello & Matheis, 2007; Morrongiello & Rennie, 1998) and that a similar tendency is found among injuries in ECECs (Alkon et al., 2000; DS, 2011; Møller & Laursen, 2010). Still, other studies have not been able to detect this gender difference (Leland et al., 1993). Some studies indicate that younger children are more prone to experience injury than older children in ECECs (Cummings et al., 1996; Eberl et al., 2009; Elardo et al., 1987), while other studies have found that a higher frequency of injuries occurred among 3-5 year-olds (Juanita Lee & Bass, 1990; Møller & Laursen, 2010).

Norwegian injury statistics show that Norwegian children have never been as safe as they are now, there has been a marked decline in the number of injuries and deaths among Norwegian children during the last 50 years (Ellingsen, 2008). Data on injuries show that each year, approximately 6,500 Norwegian children are brought in for medical care because of injuries on playgrounds (BFD, 2000), but this excludes data on details about where and when the injuries happen to children. In addition, they do not distinguish between serious or minor injuries. Therefore, it is difficult to make conclusions about the number and severity of Norwegian playground injuries. The numbers from Norwegian Statistics (2012) show that the occurrence of death injuries on playgrounds and ECECs from 1996 through 2009, was 7 incidents. This also includes injuries that happened on public playgrounds and on the ECEC playgrounds after hours when people independently visited the playground.

The prevalence of injuries in Norwegian ECECs is scarcely studied. In the Norwegian governmental document "Accidents in Norway", it is stated that Norway does not have data on the prevalence of accidents in Norwegian ECECs (Departementene, 2009). There have been some private initiatives to register injuries in Norwegian ECEC (Kompetansetorget, 2012), but they have failed to include important variables, such as the extent and degree of seriousness of ECEC injuries, when and where they happen, as well as what age and gender groups are most exposed to being injured.

The aim of this paper is, therefore, to present data from a survey of injuries in Norwegian ECECs during the year 2012. The research questions that will be in focus are:

- How many injuries occurred to children in Norwegian ECECs during 2012?
- Does the occurrence of child injuries in Norwegian ECECs during 2012 vary according to the children's gender and age?
- How serious are the injuries that occurred in Norwegian ECECs during 2012?
- What kinds of injuries occurred in Norwegian ECECs during 2012?
- Where and in what situations did injuries in Norwegian ECECs occur during 2012?

Method

The data presented in this paper derives from a retrospective survey on injuries and injury prevention work in Norwegian ECECs during the year 2012 using an electronic questionnaire (QuestBack).

Research on injury occurrences in ECECs usually takes one of two methodological approaches: a retrospective registration or a prospective registration. Retrospective registrations where the respondents report based on their own registration and/or memory, on injuries that have previously occurred, have been conducted with successful results (Briss et al., 1994; Leland et al., 1993; Schwebel et al., 2006). Other studies have received good results while using a prospective method where the respondents register each and every injury continuously over a period of time (Alkon et al., 2000; Cummings et al., 1996). General injury studies, not particularly focusing on ECECs, often make use of prospective registrations of incoming injuries at accident and emergency units in hospitals (Bienefeld et al., 1996). A retrospective design was chosen for this study as ECECs are expected to register injury continuously.

Procedure

Using previous literature on injury mapping and injury scaling, an electronic questioner was developed. The effectiveness of the questionnaire was tested in a pilot study (Teijlingen & Hundley, 2002) and sent to one hundred ECECs. The ECECs were randomly chosen within groups of ECECs to ensure that all sizes, organizations forms and ownership types were covered. The answers from the participants were studied and the questionnaire was changed to omit wording leading to misunderstandings. Because there was reason to believe that serious injuries in ECECs are not high in number (Briss et al., 1994; Cummings et al., 1996; Elardo et al., 1987; Leland et al., 1993; Schwebel et al., 2006), a consideration was made that all ECECs were to be included to ensure the capture of as many of the serious injuries as possible in the results. This was done even though the possibility of receiving a high response rate was impaired.

Sample

All 6397 Norwegian ECECs was included in the sample. The managers in each ECEC were contacted by email in December 2012. Managers from the 2105 institutions completed the questionnaire, and 27 of these responses had key variables missing and were excluded from further analyses. The remaining samples consisted of 2078 institutions, giving a response rate of 33 %.The resulting sample represented the demography of Norwegian institutions (StatisticsNorway, 2013) in terms of the geographical distribution throughout the country, distribution between private and municipal institutions, share of male/female employees, number of children, and children's age distribution (see Table 1).

Although the sample is comparable to the demography of Norwegian institutions, there is a possibility that the responding ECECs have well-established routines and that a deliberate attitude regarding injuries in ECECs is over-represented. Due to the low response rate, the results should be generalized with caution.

Table 1. Descriptive data for the sample
[2](StatisticsNorway, 2013)

	This sample	**Adjusted sample[1]**	**Norway 2012[2]**	**Diff**
Number of children	95 726	290 079	286 153	+1.4 %
0-3 year-olds	34 892	105 733	102 456	+3.2 %
3-6 year-olds	60 834	184 345	183 697	+0.4 %
Number of employees	23 893	72 403	76 002	-4.7 %
Share of 0-3 year-olds	36 %	-	36 %	0 %
Share of male employees	9.7 %	-	10.5 %	-0.7 %
Share of public institutions	43 %	-	47 %	-4 %
Children in each institution	46	-	47	-2 %

Measures

Measures of injury levels, characteristics of the moderate and severe injuries, and injury rates were retrieved from the data. Easing the reporting of the injuries and assessing the seriousness of the injuries with some sort of classification of the injuries along a seriousness scale were necessary. The scale should differentiate less serious injuries, which should be expected from normal children's play (Sandseter & Kennair, 2011), from serious injuries, which should be avoided. We utilized the work done in the EU (CEN/TC252, 2010), and the scale used in the Os municipality in Norway (Lund, 2012) was utilized to construct a four level scale, ranging from non-serious injuries to severe injuries:

1. Simple treatment/first aid from ECEC institution staff on-site or during a visited emergency room/dentist check-up, but no further treatments or check-ups from medical staff/dentist.

2. Small cuts, minor burns, small frostbite, non-lethal poisoning, sprains, small fractures of small bones in fingers, toes, arms, and legs and tooth injuries that necessitate simple treatment of medical staff/dentist.

3. Medium and major burn injuries, concussion, fainting, large cuts (more than two stitches), fractures in long bones (arms and legs), crushing of fingers and toes, and other injuries that demands treatment and follow-up from medical staff/ dentist.

4. Serious injuries with uncertain prognosis and death such as serious head injuries, internal bleeding, suffocation, and lethal or near lethal poisoning.

The form was built up from both fixed alternatives for registering the number of injuries in each level of seriousness, where numbers were provided for each of the age groups: 0-3 years and 3-6 years and for boys and girls separately. This information was used when calculating number of injuries in each injury level. For every injury in injury levels 3 and 4, the respondents were asked to describe the characteristics of the injury in regards to injury type, mechanism and environment. Respondents who

[1] The adjusted samples show this sample adjusted from 33% of the response rate to a full sample, to ease the comparison with national figures in 2012.

did not fill out this information were contacted through Questback with a reminder to volunteer this information.

Injury rates were calculated by dividing the number of injuries in each institution by the number of children in the institution. The managers reported the number of 0-3 year-olds and 3-6 year-olds in their respective institutions. This variable was used when looking at injury rates related to age. As the managers were not asked to report the distribution of children by gender, the calculated injury rate related to gender is uncertain and must be used with caution.

Analysis

To prepare the data for analysis, injuries with description levels 3 and 4 were moved to the correct injury level if they were misplaced, and mistypes were removed. The statistical analysis was descriptive (frequencies, percentages, mean, median, standard deviation), and a difference analysis between groups (i.e., T-test) was conducted. The analyses were done using the IBM SPSS Version 22.

Results

Among the 95,726 children in this sample, the ECEC managers reported a total of 13,924 injuries in 2012 (see Table 1). Among the 2078 managers in this sample, 1722 managers reported injuries in one or more of the levels. A total of 356 (17 %) of the managers did not report to having any injuries in 2012. The mean number of injuries reported by the managers was 6.7.

Table 2. Descriptive data for the injury levels (N=2078)

Injury level	Mean injuries reported per manager	Number of injuries	Managers reporting	Managers not reporting
Level 1	5.4	11.212 (80 %)	1627	451
Level 2	1.1	2331 (17 %)	841	1237
Level 3	0.2	359 (3 %)	248	1830
Level 4	0.0	22 (0.002 %)	11	2067

The reported injuries are mostly minor injuries, with 80 % belonging in level 1. 17 % of the reported injuries are found in level 2, while 3 % of the injuries were classified as moderate injuries in level 3. The 22 reported injuries in the injury level 4 amount to 0.002 % of the injuries reported.

Injury rates

The number of injured children in each institution varies from 2 to 336 children, with an average of 46 children in each institution. Hence, looking at injury rates per child gives a more meaningful picture than injuries per institution. Injury rates per child at all injury levels added together range from 0 to 4 injuries per child, with an average of 0.16 injuries per child. In injury level 1, the mean injury rate is 0.13. In injury level 2, the injury rate is 0.03, and in injury level 3, the rate is 0.004; in level 4, there is a rate of 0.0003.

Table 3. Injuries per child in the injury levels (N=2078)

Injury level	Min	Max	Mean	Median	SD
Level 1	0	3.6	0.13	0.07	0.22
Level 2	0	2.2	0.03	0	0.09
Level 3	0	0.4	0.00	0	0.02
Level 4	0	0.2	0.00	0	0.01

For all injury levels, the standard deviation is larger than the mean value, indicating a large spread in the results.

Injury rates by gender and age

Injury rates are somewhat different for the two age and gender groups (Figure 1). The mean injury rate in level 1 is 0.15 for the 0-3 year-olds and 0.13 for the 3-6 year-olds. This difference is statistically significant ($p<0.05$) using a paired sample t-test. In the other levels, there are no statistical significant differences. Boys have a statistically higher ($p<0.05$) injury rate than girls in injury levels 1, 2 and 3. In level 1, the injury rate among the boys is 0.16, while girls have an injury rate of 0.11. In injury level 2, the boys have a rate of 0.03, compared to 0.02 for the girls. For level 3, the injury rate among the boys is 0.005, while girls have an injury rate if 0.003. Still, the injuries are so rare overall, and the likelihood of being injured is so low that the gender effect would have to be interpreted as a remote possible factor. There are no significant differences in injury rates between genders when it comes to injury level 4.

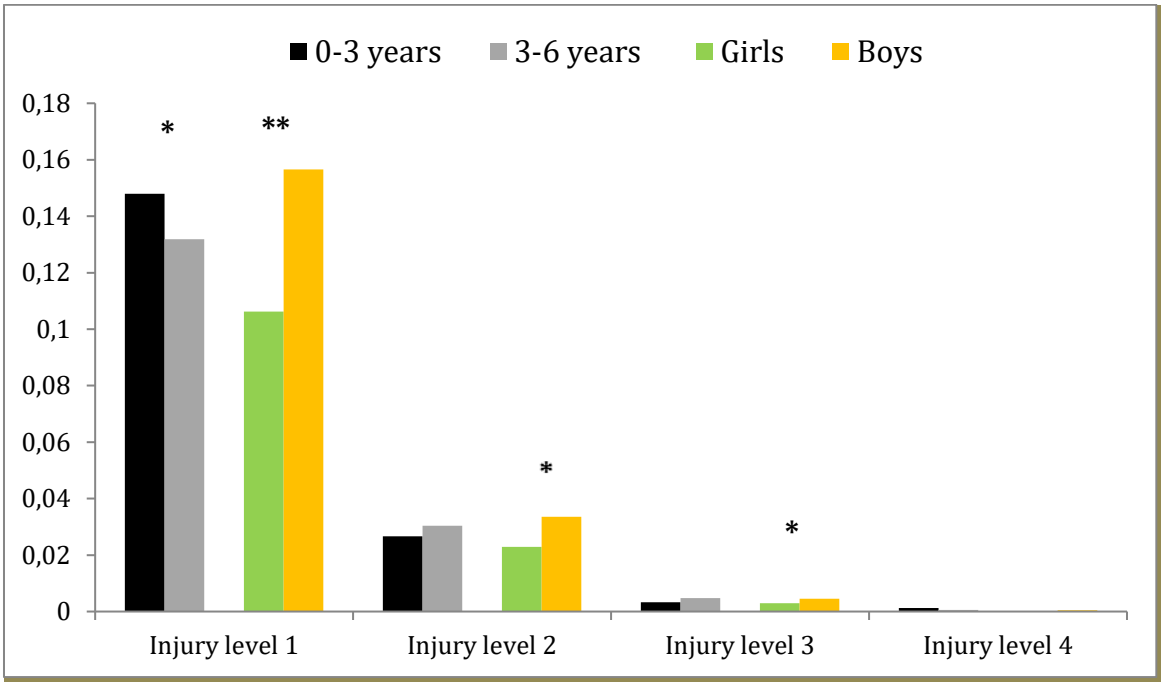

Figure 1 Injuries per child by gender and age

* Statistic significance, $p<0.05$

** Statistic significance, $p<0.001$

Characteristics of moderate injuries

Among the 359 reported injuries in injury level 3, 217 injuries (60 %) have descriptions. Of the described injuries, fractures are the most common injury type (37 %), together with concussions (30 %). Cuts amount to 14 % of the injuries in level 3. Other types of injuries like pinches, burns and dental injuries, constitute 18 % of the injuries in the moderate injury level (see Table 4).

Boys have more injuries in level 3 than girls do. A relatively larger proportion of the injuries occurring among girls are concussions than they are for boys. Boys have more cuts and other types of injuries, while fractures amount to about the same percentage of injury type for both genders. Injury types for the two age groups in the sample are quite different when it comes to fractures. A relatively larger proportion of older children's injuries are fractures than that is seen among the smaller children. For other injury types, the 0-3 year-olds have more injuries than the 3-6 year-olds.

Table 4. Injury types for described injuries on injury level 3

Injury type	**Total**		**Boys**	**Girls**	**0-3 years**	**3-6 years**
Fracture	80	37%	38%	36%	23%	41%
Concussion	66	30%	24%	41%	34%	29%
Cut	31	14%	18%	8%	17%	14%
Other types	40	18%	20%	15%	26%	16%
Total	217	100%	100%	100%	100%	100%

Falling is the main cause of injuries in level 3 with 82 % of the injuries being related to falling. Collision with objects or other children amounts to 7 % of the injuries. Other mechanisms like fighting, temperature, or external factors (such as objects falling down on children) constitute 11 % of the injuries. The distribution of mechanism is presented in Table 5.

The differences in injury mechanism are minor among boys and girls. The causes of the injury are more often falling among the older children. Other mechanisms occur more often for the smaller children. There are no notable differences when it comes to the frequency of injuries from collisions.

Table 5. Injury mechanism for the described injuries in injury level 3

Injury mechanism	**Total**		**Boys**	**Girls**	**0-3 years**	**3-6 years**
Fall	165	82%	85%	76%	71%	85%
Collision	15	7%	5%	12%	9%	7%
Other mechanisms	22	11%	10%	12%	20%	8%
Total	202	100%	100%	100%	100%	100%

Information about the environment of the injury was given in 173 of the descriptions. 65 % of these injuries occurred outdoors while 35 % of them happened indoors. This is, however, not controlled for time spent indoors and outdoors. A larger, relative proportion of the injuries occurring outdoors were fractures at 39 %, compared to the 28 % of the injuries occurring indoors. The tendency for concussions was the opposite, with a higher proportion of the injuries happening indoors as concussions at 44 % compared to those occurring outdoors at 29 %. For cuts and other types of

injuries, the relative distribution was about the same. The main cause for injuries was falling, both indoors and outdoors, with 82 % of the injuries being related to falling in both environments. Collisions were the cause of a larger proportion of outdoor injuries (11 %) than indoor injuries (3 %). Other mechanisms constituted a larger proportion of indoor injuries (15 %) than outdoor injuries (7 %).

Characteristics of severe injuries

In injury level 4, only three of the 22 reported injuries were described. Eleven of these 22 injuries were reported by two managers, leading us to believe that these injuries may be mistypes. We will still report the total number of injuries in this level, but there is uncertainty of how to interpret this particular result. The managers reporting these eleven injuries in injury level 4 did not share any further description when contacted. Nineteen of these injuries remain undescribed after several reminders. The three descriptions for injury level 4 are all fractured skulls that occurred outdoors. The first injury was to a boy in the 3 to 6 year-old age group. He had an object fall down on him during a field trip. The second injury was a girl in the 0 to 3 year-old age group. She fell down from a playground apparatus. The third description was a boy in the 3 to 6 year-old age group, who fell in the institution's outdoor space, thereby knocking his head on the asphalt.

Discussion

Prevalence of injuries in Norwegian ECECs

The results of this study show that there are few injuries in Norwegian ECECs, considering how many children spend a long number of hours in these institutions. For all injury severity levels overall, there is an average of 0.16 injuries per child per year (Table 3), which is very low. The total number of injuries in the data is 13,924 injuries, at all severity levels. From the total number of injuries, 11,212 of them are injury severity level 1. This is i.e., minor scrapes and bruises that do not require treatment from medical staff or a dentist. 2,331 of them are severity level 2, i.e., small cuts, minor burns, etc. that need simple medical treatment from professionals but no follow-up treatment) (Table 2). This means that 13,543 injuries (97 % of the total) are minor injuries. Seen in the light of the fact that 90.2 % of Norwegian children are in ECECs and that 93 % of these children spend 41 hours or more in ECECs each week (StatisticsNorway, 2014), injuries must be considered to be of low injury prevalence. This corresponds with the numbers from studies in other countries that have found a generally low number of injuries and an especially low number of severe injuries in ECECs (Briss et al., 1994; Cummings et al., 1996; Elardo et al., 1987; Leland et al., 1993; Schwebel et al., 2006).

Prevalence of injuries in Norwegian ECECs related to gender and age

The results from this study, similar to former studies on injury prevalence among children (Alkon et al., 2000; Hillier & Morrongiello, 1998; Morrongiello & Matheis, 2007; Morrongiello & Rennie, 1998; Møller & Laursen, 2010), show that boys are more prone to experience injuries (Figure 1). Injuries being so rare overall in the present study calls for a careful interpretation of gender differences, but the results show that boys experience more injuries than girls in injury severity levels 1, 2 and 3, but not in level 4.

The number of injuries in the two different age groups, 0-3 year-olds and 3-6 year-olds, shows that there is no significant difference overall, but it indicates that there is a difference in number of injuries according to severity level (Figure 1), wherein the youngest age group experiences more injuries than the oldest age group. Looking at studies from other countries when examining age differences for injuries among children in ECECs, the results are divergent with some studies showing that younger children are more often injured (Cummings et al., 1996; Eberl et al., 2009; Elardo et al.,

1987) and other studies finding that older children experience the most injuries (Juanita Lee & Bass, 1990; Møller & Laursen, 2010). Since the present study's results do not show a consistent difference in injury prevalence between the age groups, especially in the more severe injury levels where long medical treatment is needed, an age difference cannot be established here.

Characteristics of injuries in Norwegian ECECs

To be able to prevent injuries in ECECs, it is important to know more about the injuries that are likely to occur. Since injury severity levels 1 and 2 are regarded as minor and less severe injuries, a description of the injury situation was collected for levels 3 and 4, exclusively. These injuries, especially the ones considered severity level 4, are the ones that injury prevention work should be focused on.

Among the 359 reported injuries for level 3, fractures (37 %) and concussions (30 %) stand out as the most common ones. In Denmark, the numbers have shown that ECEC fractures account for 12 % of all injuries while only 3 % are concussions, and the largest group is open wounds at 39 % (Møller & Laursen, 2010). US studies on injuries in ECECs show that most injuries are cuts and scratches (31 %), followed by bruises (15 %), and then fractures at 10 % and concussions at 2 % (Briss et al., 1994). A direct comparison between our numbers and these results is not possible since our percentages are based on injuries sorted as only injury severity level 3 (moderate injuries). In addition, we do not have a detailed description of the 13,543 injuries given for levels 1 and 2. There are some differences in injury type as seen in relation to age and gender (Table 4), where girls experience more concussions than boys and boys tend to be more prone to cuts and other types of injuries. However, the most common injury, fractures, has an equal amount of occurrence between the genders. This study is not designed to gain information that can explain these gender differences, but one might think that it could be a result of boys' and girls' different preferences of play and activities. The results show that older children experience more fractures (Table 4) and injuries from falls (Table 5) than younger children; this could possibly be used as such an explanation. Older children tend to climb more and to a higher level, and thus, they would be more exposed to the possibility of falls that could lead to a fracture.

Similar to other injury studies in ECECs (Cummings et al., 1996; Elardo et al., 1987; Leland et al., 1993; Møller & Laursen, 2010), falls and collisions are the most common cause of injury in this study with falls accounting for 82 % of injuries and collisions accounting for 9 % (Table 5) in level 3. Of the described injuries in level 3 in this study, a larger proportion of the injuries happened outdoors (65 %) than they did indoors (35 %). This is in accordance with the findings from former ECEC injury research studies done in other countries (Alkon et al., 2000; Briss et al., 1994; Leland et al., 1993; Møller & Laursen, 2010). Meanwhile, a study from Minneapolis, Minnesota of the United States (Leland et al., 1993) was not able to find a difference in injury occurrence for indoors versus outdoors in ECECs.

Since Norwegian children spend a large proportion of their time in ECECs in play and outdoor activities (Helsedirektoratet 2012; Moser & Martinsen, 2010), it is not a surprise that most injuries occur outdoors. A somewhat older English study (Illingworth et al., 1975) showed that even though most injuries in playgrounds were scrapes, bruises and small cuts, the amount of fractures was quite substantial (26.5 %) while concussions were considerably lower in occurrence (6 %). In the present study, the results show that fractures account for a larger proportion of level 3 (moderate) outdoor injuries (39 %) than indoor injuries (28 %) while concussions are more common indoor injuries (44 %) than outdoor injuries (29 %). A somewhat surprising finding is that falls are the most common cause of injuries both outdoors and indoors. Still, it seems that most outdoor falls result in fractures and most indoor falls result in concussions. Further descriptions of the injury situations in the present study show that outdoor falls were often falls from trees, playground equipment and other play

structures down to 30 cm. above the ground, while indoor falls were often falls while walking/running or falls from benches and chairs at a low height, etc. Even though fractures also occur from indoor falls, falls from flat ground or low heights can more often lead to concussions rather than bone fractures.

The three injuries described in severity level 4 are all fractured skull injuries. One of the injuries was related to a fall from playground equipment on the ECECs' playground, while the other two were not related to a child's risk-taking or to a situation possible to foresee and prevent. A boy falling on flat ground in the outdoor area and an object hitting a boy when walking on a field trip, both resulting in severe injury, are happenings and consequences that are hard to prevent. How the number of severe injuries in the present study relates to comparable numbers in ECECs has not yet been possible to evaluate since no other studies in ECECs—to our knowledge—show detailed numbers and descriptions of these severe injuries. Since the rest of the injuries (19) in level 4 in this study are not described by the respondents and since two ECECs have, exclusively, reported 11 of the injuries without any descriptions, it is very difficult to interpret the results in more detail. Nevertheless, the results indicate that severe injuries are very rare in Norwegian ECECs; a result that is in accordance to the results from others' research studies on injury statistics in ECEC (Briss et al., 1994; Cummings et al., 1996; Elardo et al., 1987; Leland et al., 1993; Schwebel et al., 2006). There are no deaths among the severe injuries in the present study, and looking at Norwegian official statistics (StatisticsNorway, 2012) on death accidents, the numbers show that in a period of 14 years (1996-2009), there were only 7 death-related accidents on Norwegian playgrounds and ECECs altogether. This shows that accidents that result in death in Norwegian ECECs happen less than every second year, and therefore, it is not surprising that no deaths are reported in this study.

Limitations

This study has some limitations. The results show that there are challenges with mapping injuries in ECECs by retrospective methods (Briss et al., 1994; Leland et al., 1993; Schwebel et al., 2006). Table 3 shows a few institutions have reported a markedly higher number of injuries than the mean number of injuries. Although these outliers don't affect the mean values, it is impossible to know if some of they represent the actual number of injuries or if they could be due to human error, such as misinterpretation of injury severity level or the typing of the wrong number. These insecurities support the recommendations of registering injuries through prospective studies (Fonseca, Victoria, Halpern, Lima, & Barros, 2002). The results of this study must thus be interpreted with caution; still, they give valuable indications of the prevalence of injuries in Norwegian ECECs.

Conclusion

The aim of this study was to gain knowledge about the injury prevalence in Norwegian ECECs, including more details about the distribution of injuries as related to severity and mechanism of injuries, gender and age groups, and the characteristics of the injuries in terms of the situations in which they occur. Overall, the results of this study show that injuries are rare in Norwegian ECECs, and that most of the injuries are minor and do not require a follow-up for professional medical treatment. Very few children suffer severe injuries, and none of the injuries reported in this study resulted in death. Most injuries are actually fixed at the ECEC institution with a Band-Aid and some comforting words from the ECEC staff. There are some indications that boys experience injuries more often than girls, but regarding the low likelihood of being injured at all, these indications must be interpreted with caution. Gender analyses also show that boys experience more fractures than girls while girls experience more concussions than boys. Looking at age differences, the results show that older children experience more fractures than younger children while younger children experience

more of the other types of injuries than older children, to an extent. Most of the injuries happen outdoors while on the ECEC institution's playground or during field trips. In addition, while most fractures occur outdoors, concussions are more likely to happen indoors. As in many other studies of injury prevalence among children, the largest proportion of injuries are results from falls, both outdoors and indoors, with collisions as the next most common cause of injury.

Since injury statistics in Norwegian ECECs have been lacking (Departementene, 2009), this study contributes with new knowledge on this issue. This knowledge could also be useful for ECEC politicians and practitioners in other countries since Norwegian ECECs spend a large proportion of their time outdoors (Helsedirektoratet 2012; Moser & Martinsen, 2010), and the Norwegian ECECs give children a high degree of free mobility and play, including the possibility for risky play types (Little, Sandseter, & Wyver, 2012; Sandseter, 2010, 2012). It seems that even though Norwegian children are, to a high degree, exposed to situations that can lead to injuries, the rate of injuries is very low. This supports the understanding that a liberal approach to risky play does not lead to many injuries in ECECs. Future practice and policy in the ECEC sector should emphasize children' risky play and provide children with possibilities for physical challenges and risk taking.

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References

Alkon, A., Ragland, D. R., Tschann, J. M., Genevro, J. L., Kaiser, P., & Boyce, W. T. (2000). Injuries in child care centers: gender-environment interactions. *Injury Prevention, 6*, 214-218. https://doi.org/10.1136/ip.6.3.214

Ball, D. J. (2002). *Playgrounds - Risks, benefits and choices* (Vol. 426/2002). London: Health and Safety Executive (HSE) contract research report, Middlesex University.

Ball, D. J. (2004). Policy issues and risk-benefit trade-offs of "safer surfacing" for children's playgrounds. *Accident Analysis and Prevention, 36*, 661-670. https://doi.org/10.1016/S0001-4575(03)00088-5

BFD. (2000). Barnehagens fysiske miljø. Et temahefte om utforming av barnehagens inne- og uteområder. Barne- og familiedepartementet.

Bienefeld, M., Pickett, W., & Carr, P. A. (1996). A descriptive study of childhood injuries in Kingston, Ontario, using data from a computerized injury surveillance system. *Health Canada – Chronic Diseases in Canada, 17*(1).

Briss, P. A., Sacks, J. J., Adiss, D. G., Kresnow, M.-J., & O'Neil, J. (1994). A nationwide study of the risk of injury associated with day care center attendance. *Pediatrics, 93*(3), 364-368.

Briss, P. A., Sacks, J. J., Adiss, D. G., Kresnow, M.-J., & O'Neil, J. (1995). Injuries from falls on playgrounds. *Archives of Pediatrics & Adolescent Medicine, 149*, 906-911. https://doi.org/10.1001/archpedi.1995.02170210080014

CEN/TC252. (2010). Guidelines for the management of the Community Rapid Information System 'RAPEX' established under Article 12 and of the notification procedure established under Article 11 of Directive 2001/95/EC (the General Product Safety Directive) *Official Journal of the European Union*: Doc. number N 879.

Chalmers, D. (1999). Playground injury - The kids are still falling for it. *Childrenz, 3*(2), 29-32.

Chalmers, D. (2003). Playground equipment safety standards. *Safe Kids News*(21), 4.

Chalmers, D., Marshall, S. W., Langley, J. D., Evans, M. J., Brunton, C. R., A-M., K., & Pickering, A. F. (1996). Height and surfacing as risk factors for injury in falls from playground equipment: A casecontrol study. *Injury Prevention, 2*, 98-104. https://doi.org/10.1136/ip.2.2.98

Cummings, P., Rivara, F. P., Boase, J., & MacDonald, J. K. (1996). Injuries and their relation to potential hazards in child day care. *Injury Prevention, 2*, 105-108.

Departementene. (2009). *Ulykker i Norge. Nasjonal strategi for forebygging av ulykker som medfører personskade 2009–2014*. Retrieved from https://www.regjeringen.no/globalassets/upload/hod/dokumenter-fha/i-1146-ulykker-i-norge.pdf

DS. (2011). Sociale ydelser til børn og unge *Danmarks Statistik.* Retrieved from http://www.dst.dk/da/Statistik/emner/sociale-ydelser/sociale-ydelser-til-boern-og-unge.aspx

DSB. (1996). *FOR 1996-07-19 nr 703: Forskrift om sikkerhet ved lekeplassutstyr*. Norwegian Directorate for Civil Protection and Emergency Planning: http://www.lovdata.no/cgi-wift/ldles?doc=/sf/sf/sf-19960719-0703.html

Eberl, R., Schalamon, J., Singer, G., Ainoedhofer, H., Petnehazy, T., & Hoellwarth, M. E. (2009). Analysis of 347 kindergarten-related injuries. *European Journal of Pedriatics, 168*(2), 163-166. https://doi.org/10.1007/s00431-008-0723-0

Elardo, R., Solomons, H. C., & Snider, B. C. (1987). An analysis of accidents at a day care center. *American Journal of Orthopsychiatry, 57*(1), 60-65. https://doi.org/10.1111/j.1939-0025.1987.tb03509.x

Ellingsen, D. (2008). Tryggere, men kanskje kjedeligere. *Sikkerhet, 5*.

Fonseca, S., Victoria, C., Halpern, R., Lima, R., & Barros, F. (2002). Comparison of two methods for assessing injuries among pre-school children. *Injury Prevention, 8*, 79-82. https://doi.org/10.1136/ip.8.1.79

Hagen, T. L., & Sandseter, E. B. H. (2010). Sikkerhet ved bevegelseslek i barnehagen. In E. B. H. Sandseter, T. L. Hagen & T. Moser (Eds.), *Kroppslighet i barnehagen - pedagogisk arbeid med kropp, bevegelse og helse* (pp. 391-403). Oslo: Gyldendal Akademisk.

Helsedirektoratet. (2012). Måltider, fysisk aktivitet og miljørettet helsevern I barnehagen. En undersøkelse blant styrere og pedagogisk ledere. IS-0345. Retrieved from www.helsedirektoratet.no

Hillier, L. M., & Morrongiello, B. A. (1998). Age and gender differences in school-age children's appraisals of injury risk. *Journal of Pediatric Psychology, 23*, 229-238. https://doi.org/10.1093/jpepsy/23.4.229

Humphreys, A. P., & Smith, P. K. (1987). Rough and tumble, friendship, and dominance in schoolchildren: Evidence for continuity and change with age. *Child Development, 58*, 201-212. https://doi.org/10.2307/1130302

Illingworth, C., Brennan, P., Jay, A., Al-Ravi, F., & Collick, M. (1975). 200 injuries caused by playground equipment. *British Medical Journal, 4*, 332-334. https://doi.org/10.1136/bmj.4.5992.332

Juanita Lee, E., & Bass, C. (1990). Survey of accidents in a university day-care center. *Journal of Pediatric Health Care, 4*(1), 18-23. https://doi.org/10.1016/0891-5245(90)90035-5

Kompetansetorget. (2012). Den store barnehageundersøkelsen. Oslo: Kompetansetorget.

Leland, N., Garrard, J., & Smith, D. (1993). Injuries to preschool-age children in day-care centers. *American Journal of Diseases of Children, 147*, 826-831. https://doi.org/10.1001/archpedi.1993.02160320028014

Little, H. (2006). Children's risk-taking behaviour: Implications for early childhood policy and practice. *International Journal of Early Years Education, 14*(2), 141-154. https://doi.org/10.1080/09669760600661427

Little, H., Sandseter, E. B. H., & Wyver, S. (2012). Early childhood teachers' beliefs about children's risky play in Australia and Norway. *Contemporary Issues in Early Childhood, 13*(4), 300-316. https://doi.org/10.2304/ciec.2012.13.4.300

Lund, H. (2012). Kommunal (lokal) skaderegistrering. Retrieved from http://www2.sfj.no/cmssff/cmsmm.nsf/lupGraphics/Trygge%20lokalsamfunn%20Helge%20Lund.pdf/$file/Trygge%20lokalsamfunn%20Helge%20Lund.pdf

Mack, M. G., Hudson, S., & Thompson, D. (1997). A descriptive analysis of children's playground injuries in the United States 1990-4. *Injury Prevention, 3*, 100-103. https://doi.org/10.1136/ip.3.2.100

Morrongiello, B. A. (2005). Caregiver supervision and child injury risk: I. Issues in defining and measuring supervision; II. Findings and directions for future research. *Journal of Pediatric Psychology, 30*(7), 536-552. https://doi.org/10.1093/jpepsy/jsi041

Morrongiello, B. A., Carbett, M., McCourt, M., & Johnston, N. (2006). Understanding unintentional injury risk in young children II: The contribution of caregiver supervision, child attributes, and parent attributes. *Journal of Pediatric Psychology, 31*, 540-551. https://doi.org/10.1093/jpepsy/jsj073

Morrongiello, B. A., & Matheis, S. (2007). Understanding children's injury-risk behaviors: The independent contributions of cognitions and emotions. *Journal of Pediatric Psychology, 32*(8), 926-937. https://doi.org/10.1093/jpepsy/jsm027

Morrongiello, B. A., & Rennie, H. (1998). Why do boys engage in more risk taking than girls? The role of attributions, beliefs, and risk appraisals *Journal of Pediatric Psychology, 23*(1), 33-43.

Moser, T., & Martinsen, M. (2010). The outdoor environment in Norwegian kindergartens as pedagogical space for toddlers' play, learning and development. *European Early Childhood Education Research Journal, 18*(4), 457-471. https://doi.org/10.1080/1350293X.2010.525931

Mowat, D. L., Wang, F., Pickett, W., & Brison, R., J. (1998). A case-control study of risk factors for playground injuries among children in Kingston and area. *Injury Prevention, 4*, 39-43. https://doi.org/10.1136/ip.4.1.39

Møller, H., & Laursen, B. (2010). Ulykker i vuggestuer og børnehaver. *Uddannelsesudvalget 2009-10.* Retrieved from http://www.ft.dk/samling/20091/almdel/udu/spm/226/svar/697585/816973.pdf

NMER. (2005). *Act no. 64 of June 2005 relating to Kindergartens (the Kindergarten Act)* Oslo: Norwegian Ministry of Education and Research.

NMER. (2006/2011). *Framework Plan for the Content and Tasks of Kindergartens, issued 1. March*. Oslo: Norwegian Ministry of Education and Research.

Peterson, L., Gillies, R., Cook, S., Schick, B., & Little, T. (1994). Developmental patterns of expected consequences for simulated bicycle injury events. *Health Psychology, 13*, 218-223. https://doi.org/10.1037/0278-6133.13.3.218

Phelan, K., Khoury, J., Kalkwarf, H., & Lamphear, B. (2001). Trends and patterns of playground injuries in United States. *Ambulatory Pediatrics, 1*, 227-233. https://doi.org/10.1367/1539-4409(2001)001<0227:TAPOPI>2.0.CO;2

Sandseter, E. B. H. (2010). *Scaryfunny - A qualitative study of risky play among preschool children* (PhD avhandling), NTNU, Trondheim.

Sandseter, E. B. H. (2012). Restrictive safety or unsafe freedom? Norwegian ECEC practitioners' perceptions and practices concerning children's risky play. *Childcare in Practice, 18*(1), 83-101. https://doi.org/10.1080/13575279.2011.621889

Sandseter, E. B. H., & Kennair, L. E. O. (2011). Children's risky play from an evolutionary perspective: The anti-phobic effects of thrilling experiences. *Evolutionary Psychology, 9*(2), 257-284. https://doi.org/10.1177/147470491100900212

Sandseter, E. B. H., & Sando, O. J. (2016). " We Don't Allow Children to Climb Trees": How a Focus on Safety Affects Norwegian Children's Play in Early-Childhood Education and Care Settings. *American Journal of Play, 8*(2), 178.

Sawyers, J. K. (1994). The preschool playground. Developing skills through outdoor play. *Journal of Physical Education, Recreation & Dance, 65*(6), 31-33.

Schwebel, D. C., Brezausek, C. M., & Belsky, J. (2006). Does time spent in child care Influence risk for unintentional injury? *Journal of Pediatric Psychology, 31*(2), 184-193. https://doi.org/10.1093/jpepsy/jsj007

Smith, S. J. (1998). *Risk and our pedagogical relation to children: On playground and beyond*. New York: State University of New York Press.

StatisticsNorway. (2012). Tabell: 03516: Dødsulykker, etter skadested og aktivitet Retrieved from http://statbank.ssb.no/statistikkbanken/Default_FR.asp?PXSid=0&nvl=true&PLanguage=0&tilside=selectvarval/define.asp&Tabellid=03516

StatisticsNorway. (2013). Kindergartens by county, 2012. Retrieved from https://ssb.no/a/english/aarbok/tab/tab-158.html

StatisticsNorway. (2014). Kindergartens, 2013, final statistics. Retrieved from https://ssb.no/en/utdanning/statistikker/barnehager

Taylor, S. I., & Morris, V. G. (1996). Outdoor play in early childhood education settings: Is it safe and healthy for children? *Early Childhood Education Journal, 23*(3), 153-158. https://doi.org/10.1007/BF02364750

Teijlingen, E., & Hundley, V. (2002). The importance of pilot studies. *Nursing Standard, 16*(40), 33-36. https://doi.org/10.7748/ns2002.06.16.40.33.c3214 https://doi.org/10.7748/ns.16.40.33.s1